Managing acute and chronic renal stone disease

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NEPHROLITHIASIS, OR RENAL STONE DISEASE, IS COMMON AND THE INCIDENCE IS INCREASING globally. In the UK, the lifetime risk is estimated to be 8-10%. Historically there has been a three-fold higher incidence of renal stones in men compared with women; however, this gender gap appears to be closing. The age of onset of a first stone has also changed in recent years with more people symptomatic at a younger age, though calculi remain relatively uncommon before the age of 20 years. It is estimated that as many as 50% of stone formers will have at least one more symptomatic stone in their lifetime, with numerous stone recurrences seen in approximately 10%. In the UK, the majority of stones are calcium based, and associated with oxalate or phosphate or both. A minority of patients will have an underlying identifiable metabolic disorder or aetiology. However, even in the group of 'idiopathic' stone formers, there are known common factors that predispose to calculus precipitation such as high salt intake, low fluid intake, and White ethnicity. Those with metabolic syndrome are also at increased risk of stone formation. On a population level, the increase in stone incidence, erosion of gender disparity, and younger age of onset is likely to reflect obesity and a Western diet with a high intake of animal protein and salt.

Renal stones can be classified in a variety of ways, see table 1, p18. The size and anatomical location are relevant to the acute management of renal colic. These two factors dictate likelihood of spontaneous stone passage or need for acute intervention. The aetiology of stone formation has implications for chronic disease management in terms of reducing the likelihood of stone recurrence, see table 2, p18.

PRESENTATION
The classical presentation of a kidney stone is with acute renal or, more accurately, ureteric colic. The patient will present to primary care or the emergency department with acute severe unilateral loin or flank pain. Typically there are acute spasms of severe pain. Radiation of the pain to the groin, and then testicles in men and labia in women, occurs as a stone migrates caudally. Nausea, vomiting and visible haematuria can accompany the pain. The constellation of renal angle

How do patients with renal stones present?
How can risk of recurrence be reduced?
When should patients be referred?
tenderness and haematuria on urinalysis, accompanying an acute onset of loin-to-groin colicky pain has a reported sensitivity in excess of 80% and specificity approaching 100% for renal stone disease.\(^6,7\) It is important to remember that absence of non-visible haematuria on urinalysis does not exclude a diagnosis of renal stone disease. The list of potential differential diagnoses of abdominal pain with nausea and vomiting is of course substantial.\(^6\) Patients with peritonitis typically lie still as movement exacerbates their pain, while retroperitoneal pathology is classically associated with the ‘restless rollers’. Testicular pathology is often associated with tenderness, but this sign is not present if the testicular symptoms are related to ureteric colic. Where there is diagnostic uncertainty as to the aetiology of signs and symptoms, haemorrhage from abdominal aortic aneurysm should be among the differential diagnoses in at-risk populations and prompt urgent referral.

**Radiation of the pain to the groin occurs as a stone migrates caudally**

Loin pain and haematuria can have a non-calculus aetiology. Upper urinary tract infection, clot, tumour, or sloughed renal papilla may present in a similar manner.\(^6\) Such pathology will be present in only a minority of cases and the distinction can be made in secondary care where additional investigations are available. Identification in primary care of the correct anatomical site of pathology will ensure direction to the appropriate service.

Increasingly asymptomatic renal calculi are detected incidentally on imaging, (typically CT scanning), for another reason. Often these are very tiny flecks of calcification, perhaps 2 or 3 mm in diameter. The patient typically has no personal or family history of stone disease and examination (including urinalysis) is unremarkable. These patients should be given the same advice about reducing recurrence as symptomatic stone formers (see p20). In addition, they need to be informed about potential complications as they may develop symptomatic disease. Routine re-evaluation by interval scanning is not required in the absence of symptoms.

**INVESTIGATION**

A minimum set of investigations required for all patients at first presentation of symptomatic renal stone disease are listed in Table 3, opposite.\(^8\) These relate to:

- Confirmation of diagnosis and quantification of stone burden
- Management of the acute presentation. (Is there renal impairment or infection?)
- Exclusion of common underlying metabolic abnormalities. (Is there hypercalcaemia or hyperuricaemia?)

Stone analysis should be performed whenever possible. Biochemical determination of stone composition can guide subsequent therapy to reduce recurrence risk. During an acute episode the patient should be asked to pass urine through a sieve and retain the stone or gravel for biochemical analysis if possible.\(^9\)

Stones can be detected by a variety of methods including ultrasound, intravenous urography, and non-contrast CT scans. MRI can also be used to characterize stones and identify associated pathology. The combination of these investigations allows for accurate localization and characterization of stones, guiding appropriate management strategies.

**FIGURE 2**

X-ray KUB showing a right-sided staghorn calculus and a JJ-stent in the right renal pelvis
of imaging techniques. The gold standard is a non-contrast CT of kidneys, ureters and bladder (KUB), which can identify > 99% of stones.\(^8\)

CT KUB should be the primary mode of imaging for all patients with colic unless contraindicated; see figure 1, p17. In such instances, or if a CT KUB is not available, ultrasound KUB is an alternative. This has advantages in terms of radiation exposure and cost, but is limited in sensitivity, particularly for ureteric stones. Once diagnosed, a plain film KUB can be used for follow-up of radiopaque stones.

**‘CT KUB should be the primary mode of imaging for all patients with colic’**

Additional testing is indicated for those with recurrent disease or when there are multiple stones on imaging at presentation. Other clinical features that suggest there may be an underlying abnormality are outlined in table 4, below.

Two 24-hour urinary collections are required for a complete metabolic screen,\(^2\) (urinary volume, total excretion of sodium, calcium, phosphate, oxalate, and citrate, urinary pH value and presence of cystine are of particular interest), but analysis of results will be undertaken in secondary care.

**ACUTE MANAGEMENT**

Patients with acute ureteric colic may be safely managed in primary care. However, referral for emergency care must be considered for certain patients who are at significant risk of complications from a renal stone. This can be gauged by the medical history, current clinical status, and response to initial treatment. The clinical features necessitating emergency referral are outlined in table 5, right.\(^9\)

For most patients diclofenac is a reasonable first choice of analgesia, e.g. 50-100 mg rectally, or 75 mg IM. Opioid medication can worsen nausea and be less effective, but should be used (e.g. 2.5 mg SC diamorphine) if there is a contraindication to NSAIDs. A combination of diclofenac, paracetamol, and/or codeine regularly can provide adequate pain control for many patients.\(^5\) Failure of this analgesic combination should prompt consideration of secondary care support.

Parenteral antiemetic therapy may be required initially, cyclizine or metoclopramide are common choices, and can then be switched to oral administration.\(^9\)

Referral to hospital for fast-track imaging (CT KUB) is required, and should be performed within seven days. Clearly worsening symptoms or development of infection will require acceleration of investigation and emergency management. Patients should be advised to seek medical attention if they develop a fever, are unable to tolerate fluids, or have recurrence of severe pain.\(^9\)

If a ureteric stone < 5 mm in diameter is identified, the expectation is that this will pass without intervention.\(^5\) It is reasonable to continue medical management for up to four weeks. Alpha-blockade (e.g. tamsulosin 400 µg daily) was previously advocated to reduce transit time and symptoms, however, evidence from a large randomised controlled trial in 2015 did not support its use in reducing the need for subsequent intervention.\(^10\) A KUB plain film should be requested to ensure the stone has passed. If it has not, urology assessment is required.

Initially medical management as outlined above is still useful for stones between 5 and 10 mm in diameter, but urology input is more likely to be necessary as up to 50% of these may require intervention.

**Table 3**

| Investigations required for all patients presenting with renal colic |
|---|---|---|
| Urine | Blood | Imaging |
| Urinalysis | Renal function | CT KUB* |
| — Blood | Electrolytes |  |
| — Leukocytes | — Calcium |  |
| — Nitrites | — Phosphate |  |
| Culture | — Bicarbonate |  |
| Uric acid |  |  |

*CT kidney, ureters, and bladder (unless contraindicated, in which case consider ultrasound scan)

**Table 4**

| Features suggestive of a metabolic or anatomical abnormality |
|---|---|
| Clinical presentation | Young age of onset | Early recurrence (especially < 1 year) |
| Biochemical analysis | Hypercalcaemia | Metabolic acidosis (low bicarbonate) |
| Stone analysis | Non-calcium |  |

**Table 5**

| Clinical features necessitating emergency referral to secondary care |
|---|---|---|
| Medical history | Kidney transplant | Stages 3-5 |
| | Single functioning kidney |  |
| | Pregnancy |  |
| | Chronic kidney disease |  |
| Clinical status | Signs of infection | Unwell, febrile |
| | Passing minimal or no urine | Urinalysis: leukocytes ± nitrites |
| | Diagnostic uncertainty | e.g. need exclusion of aortic aneurysm |
| | Poor social support |  |
| Response to treatment | Unable to maintain oral intake |  |
| | Unable to tolerate medication |  |
| | Poor control of symptoms |  |
Stones > 10 mm in diameter should be discussed with the urology service as they are unlikely to pass spontaneously.5

REducing recurrenCe
Stone recurrence is common and should be anticipated in patients with underlying genetic or metabolic abnormalities, those with staghorn calculi (see figure 2, p18), and individuals who have previously required intervention for stone disease. These patients are typically followed up (at least initially) in secondary care.

‘Patients should be advised to drink enough so that their urine looks like a gin and tonic, not a pint of lager’

However, the most important advice for all patients, regardless of stone composition, is a copious fluid intake.1023 Some patients may find it helpful to have a numerical value attached to the actual volume they should drink, in which case they should be advised to drink a minimum of 2 to 2.5 litres per day.1

Of course, the appropriate volume is variable and will depend also on insensible fluid losses. The goal is to produce dilute urine. A simple, useful and accurate marker of having achieved this is the colour of the urine. Patients should be advised to drink enough so that their urine looks clear in colour, (like a gin and tonic and not a pint of lager!). Recurrent stone formers should be advised to drink a glass of water when going to bed at night, ideally so they have to get up at least once to pass urine, at which stage they should have another glass of water. This minimises the risks associated with several hours of concentrated urine overnight.

Patients should avoid a high-salt intake and maintain a healthy weight.5 Specific dietary measures are only required when there are recurrent calculi.

potassium citrate, D-penicillamine, captopril.

CoNClusion
Only a minority of patients with renal stone disease will have a primary metabolic or anatomical abnormality, but despite this recurrent stone formation is common.

There are simple measures that can greatly reduce the risk of stone formation, and the associated morbidity. Successful management is a partnership between the patient and the primary care team, with specialist input required occasionally for high-risk patients or those with recurrent or difficult to manage disease.

REFERENCES

Useful information
British Association of Urological Surgeons www.baus.org.uk/patients/conditions/6/kidney_stones
Edinburgh Renal Unit www.edrep.org/pages/edreninfo/kidney-stones.php